

Flight Advisor Corner by Hobie Tomlinson

March 2011

Human Factors, Part IV

This month we will continue our series on **Human Factors** by looking at the ***Physiological and Psychological Factors of Stress and Fatigue***.

Stress is a term that is derived from an engineering context where it means a force which when applied to an object, causes straining, bending, or breaking. When applied to humans, stress is the body's response to the demands placed upon it by life's events, either pleasant or unpleasant. Stress is a fact of life, especially in modern America. If you are still breathing, you have stress! The only real questions being how much, how is it affecting us, and what can we do about it?

Stress is a Necessary and inevitable part of life because it provides us with motivation and heightens our response to meet whatever challenges may arise. The relationship between stress and performance is well documented. When stress is nonexistent (such as during the cruise portion of a highly automated flight) motivation and attention are minimal, resulting in poor monitoring performance. As stress increases, so does attention and motivation, resulting in increased performance - which is why we oftentimes make better approaches and landing under less than ideal circumstances. However, when stress levels become excessive, performance will rapidly decrease. In some extreme cases this can even lead to panic with its resultant loss of effective cognitive function.

The Most Common Stress Producer is time compression (lack of adequate time to complete the desired task). Time compression can be imposed either internally or externally and can be real or perceived. The important thing to realize is that time compression which is self-imposed (internal and/or perceived) will have the same stress effect as time compression which is not self-imposed (external and/or real).

The Types of Stress Producers are as follows:

- **Physical Stressors** include temperature/humidity extremes, noise, vibration, lack of adequate oxygen and demanding physical activity.
- **Physiological Stressors** include fatigue, lack of physical fitness, sleep deprivation, inadequate nutrition, bladder/bowel discomfort, and disease.
- **Emotional Stressors** include social and personal factors related to life events and complex mental tasks.

Initially some stress can be desirable and it actually improves performance. However, when stress continues to increase and then persists over a long periods of time, performance is affected adversely. With the onset of stress, performance will generally begin to increase, but it will then peak as the stress levels increase. Performance begins to rapidly fall off when the stress levels start to exceed the individual's ability to cope.

Flight Advisor Corner by Hobie Tomlinson

During Stress Levels beyond the level which produces peak performance, judgment begins to deteriorate while performance also starts to sharply decline. Complex and/or unfamiliar tasks require a much higher level of performance than simple and/or overlearned tasks. It is for this reason that complex and/or unfamiliar tasks are even more adversely affected by increasing stress levels than simple or familiar tasks.

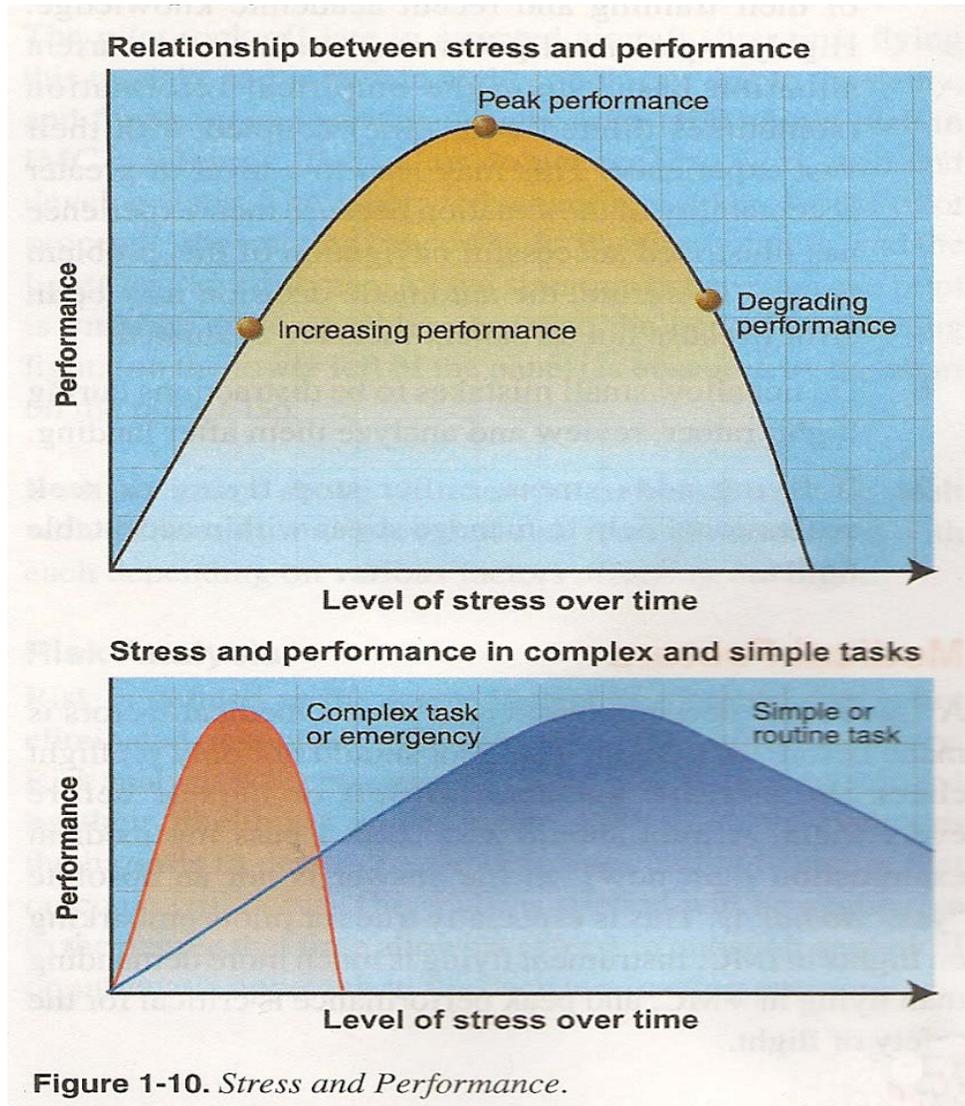


Figure 1-10. Stress and Performance.

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Stress Effects are Cumulative and every person has a limit to their stress adaptation ability. This limit is called a person's stress tolerance level (or channel capacity) and is based on the individual's ability to cope with the situation. One of the major reasons why proper initial and recurrent training is so vitally important is because it dramatically increases an individual's stress tolerance level. This is just as true in driving airplanes as training for combat!

Flight Advisor Corner by Hobie Tomlinson

The Indicators of Excessive Stress Levels are as follows:

- **Emotional Indicators** of excessive stress levels are over-compensation, denial, suspicion, paranoia, agitation, restlessness and/or defensiveness.
- **The Physical Indicator** of excessive stress levels is acute fatigue. Its accompanying symptoms are listed below under fatigue.
- **Behavior Indicators** of excessive stress levels are sensitivity to criticism, tendency to be argumentative, arrogance and/or hostility.

Life Stress-Reduction Techniques are as follows:

- **Become Knowledgeable** about stress.
- **Periodically Make a Realistic** self-assessment of your life's base-line stress levels.
- **Use a Systematic** approach to problem solving.
- **Develop a Lifestyle** which will provide a buffer against the effects of stress.
- **Practice** behavior management techniques.
- **Establish and Maintain** a strong support network of family members and/or trusted friends.

Flight Deck Stress Management begins with good life stress management! Stress coping techniques practiced for life-stress management are not usually workable in the cockpit. Instead, pilots must learn to relax and think rationally when stress appears. Some of the methods for flight deck stress management are as follows:

- **Avoid Situations** which distract from flying the aircraft
- **Reducing Flight Deck Workload** reduces stress levels! This will allow a proper environment for good Aviation **D**ecision **M**aking. Allow adequate time for proper preflight planning. Because stress levels are highest during the takeoff and landing phases, use the lower stress levels of preflight and cruise to properly plan and prioritize flight deck duties. This will reduce stress levels during the highest stress phases of flight which will dramatically aid in retaining the capacity to maintain proper situational awareness.
- **Remain Calm** when a problem occurs. When time is not a pressing factor, use an analytical approach to decision-making. Think about the problem,

Flight Advisor Corner by Hobie Tomlinson

weigh the alternatives, select and implement an appropriate course of action and then continually evaluate its effectiveness.

- **Especially Remain Calm** when an emergency occurs! Then use the ADM process to resolve the emergency. The emergency ADM process needs to rely on proper training (adequate recall of immediate response memory items) and enough recent training experience to automatically respond to any emergency situation in a timely manner. Periodic recurrent training in performing the required emergency procedures will greatly reduce your stress levels when the actual emergency event occurs. (When is the last time you practiced forced landings?)
- **Become Totally Familiar** with your aircraft and its normal, abnormal and emergency procedures. *Train sufficiently to maintain your flight proficiency. This will build confidence and reduce in-flight stress!*
- **Know and Respect Both** your personal limits and limits of your equipment. Studies suggest that high time pilots are willing to accept higher risk levels than low time, inexperienced pilots. Low time pilots tend to make decisions which are closely aligned with their initial training and recent academic knowledge, while higher time pilots tend to downplay the actual risks involved with a particular flight. They usually make these decisions based only upon inadequate empirical evidence about the hazards confronting a particular flight and/or their previous successful conclusion of flights involving similar issues. This often leads them into a salient type of automatic decision making which is seriously flawed due to the fact that not all relevant facts and/or hazards are properly evaluated. *This issue was well illustrated by the tragic Scott Crossfield weather accident while flying his Cessna Centurion.*
- **Do Not Allow** minor in-flight errors to distract you while flying. Review and analyze them after landing.
- **Whenever Flying** adds even more to life's stress, either stop flying or seek outside help which will enable you manage your stress within acceptable limits.

Fatigue is a Normal Occurrence in everyday life and can be either **Acute** or **Chronic**.

The Causes of Fatigue are as follows:

- **Lack of Restful Sleep** – Humans require eight of hours sleep per night. Anything less creates a “sleep deficit” which must be made up in the future.
- **Strenuous Activity** – Either at work or at play.

Flight Advisor Corner by Hobie Tomlinson

- **Dehydration** – Humans need water, stay hydrated.
- **Excess Caffeine** – Prevents restful sleep.
- **Noise and Vibration** – Protect your hearing at work or at play.
- **Illness** – Working while sick.
- **Self-Medication** – Antihistamines have sedation side effects.
- **Hypoglycemia** – Insure proper nutrition is maintained.
- **Impaired Vision** – Wear your glasses
- **Thermal** – Maintain proper cockpit temperatures whenever possible
- **Boredom** – Quickly produces perceived fatigue, stay active
- **Circadian Change** – Multiple times zones or shift work, plan compensatory rest time.
- **Skill Fatigue** – Occurs from persistent concentration on complex aviation tasks.
- **Unresolved Stress** – A fact of modern life, however it drains the body of energy and can lead to depression.

The Effects of Fatigue are as follows:

- **Increased Reaction Time** – Automatic and instinctual response to abnormal and emergency situations is slowed.
- **Channelized Thought Process** – Multi-tasking is restricted as the individual concentrates on one thought or activity at a time, severely restricting the person's ability to complete complex tasks.
- **Fixation** – Occurs and causes the individual to concentrate on a single item, while simultaneously missing many others.
- **Short-Term Memory Loss** – Occurs as the individual quickly forgets the next procedural steps.
- **Impaired Judgment/Decision Making** – The individual makes unnecessary mistakes, even while taking shortcuts and unwise chances, rather than following acceptable procedures. Risk assessment is minimized and flawed.

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- **Easily Distracted** – Irrelevant conversations, sounds or other random events cause important procedural items to be missed.
- **Sloppy work** – Fine motor skills are compromised and normally instinctive skills require excessive thought.
- **Decreased Visual Perception** – Individual takes longer to refocus from distant to near objects and visual scan slows down.
- **Loss of Initiative** – Individual doesn't care anymore and is unwilling to maintain a high level of skill or accuracy.
- **Personality Change** – Individual becomes irritable with increasing intolerance for others minor faults.
- **Attitude** – Individual willing to settle for less and is not aware of their decreased performance.
- **Depression** – Begins to occur with the individual taking a very negative outlook on life.

Acute Fatigue is the tiredness felt after long periods of physical and mental strain, including strenuous muscular effort, immobility, intense mental workload, strong emotional pressure, monotony, and/or lack of sleep. *It is a normal occurrence in everyday life and is prevented by adequate rest, regular exercise and proper nutrition.*

Chronic Fatigue occurs when inadequate time for a full recovery from acute fatigue occurs repeatedly. Chronic fatigue's underlying cause is usually not rest related and typically involves both physiological and psychological issues. *Thus chronic fatigue is rarely resolved by rest alone.*

Chronic Fatigue's underlying psychological problems such as financial, home life, and/or job related stresses cause a lack of qualified rest which can only be resolved by mitigating the root causes. *Without some type of resolution, performance continues to decline, judgment becomes impaired and/or unwarranted risks are taken.* Recovery from chronic fatigue requires a deliberate and prolonged solution. Unless chronic fatigue is dealt with, personal performance can become so impaired that it adversely affects pilot judgment and decision-making. *An individual suffering from chronic fatigue usually requires the assistance of a family member and/or trusted friend to even recognize the condition, not to mention treating it.*

That concludes this month's topic. Next month we will look at some medical factors Aviation Decision Making (ADM).

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The thought for this month is **“Ability is what you are capable of doing. Motivation determines what you do. Attitude determines how well you do it.”** ~ *Lou Holtz, American Football Coach*

So, until next month, be sure to **“Think Right to FliRite!”**



B747-131 Flight Engineer Panel ~ A Bygone Era